

What is claimed is:

1. An article of manufacture comprising:
5 a substrate comprising silicon, noble metal, plastics, polyimide, or combinations thereof;
and an adhesive comprising the reaction product of:
epoxy resin;
catalyst or curative; and
10 epoxy reactive thioether-containing compound, adhesively bonded to the substrate.

2. The article of claim 1 wherein the plastic is selected from the group
consisting of acrylonitrile-butadiene-styrene, poly(methyl methacrylate), polycarbonate, or
mixtures thereof, and wherein the epoxy reactive thioether-containing compound has a
molecular weight of from about 320 to about 650.

3. The article of claim 1 wherein the noble metal is selected from the group
consisting of gold, platinum, palladium, silver, iridium, and combinations thereof.

4. The article of claim 1 wherein the silicon is selected from the group
consisting of silicon dioxide, silicon die, and combinations thereof.

5. The article of claim 1 wherein the epoxy reactive thioether-containing
compound comprises a thioether di-epoxide.

6. The article of claim 1 wherein the epoxy resin comprises a polyfunctional
phenolic glycidyl ether epoxy resin.

7. The article of claim 1 wherein the epoxy reactive thioether-containing
compound is selected from the group consisting of 2-{{3-((2-{{3-(2-
30 oxiranylmethoxy)propyl}sulfanyl}ethyl)sulfanyl}ethyl}sulfanyl)propoxy)methyl}oxirane;
2({3-((6-{{3-(2-oxiranylmethoxy)propyl}sulfanyl}hexyl)sulfanyl)propoxy)methyl}oxirane;

and 2-({3-[(2-{[3-(2-oxiranylmethoxy)propyl]sulfanyl}ethoxyethoxyethyl)sulfanyl]propoxy}methyl)oxirane, and combinations thereof.

- 5 8. A method of bonding a substrate comprising the steps of:
- contacting the substrate with an adhesive composition comprising a mixture
- of: epoxy resin; catalyst or curative; and epoxy reactive thioether-containing compound; and
- curing the adhesive composition, wherein the substrate comprises silicon,
- noble metal, plastics, polyimide, or combinations thereof.

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 9. The method of claim 8 wherein the plastic is selected from the group

 consisting of acrylonitrile-butadiene-styrene, poly(methyl methacrylate), polycarbonate, or

 mixtures thereof, and wherein the epoxy reactive thioether-containing compound has a

 molecular weight of from about 320 to about 650.

 10. The method of claim 8 wherein the substrate is a print head or an inkjet

 cartridge.

 11. A curable adhesive composition useful for bonding substrates comprising

 silicon, noble metal, plastics, polyimide, or a combination thereof comprising a mixture of:

 epoxy resin;

 catalyst or curative; and

 epoxy reactive thioether-containing compound.

25 12. The curable adhesive composition of claim 11 wherein the epoxy reactive

 thioether-containing compound has a molecular weight of from about 320 to about 650.

 13. The curable adhesive composition of claim 12 wherein the epoxy reactive

 thioether-containing compound comprises a thioether di-epoxide.

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14. The curable adhesive composition of claim 11 wherein the epoxy resin comprises a polyfunctional phenolic glycidyl ether epoxy resin.

15. The curable adhesive composition of claim 11 wherein the epoxy reactive thioether-containing compound is selected from the group consisting of 2-([3-([2-([3-(2-oxiranylmethoxy)propyl)sulfanyl]ethyl)sulfanyl]ethyl)sulfanyl]propoxy)methyl)oxirane; 2-([3-([6-([3-(2-oxiranylmethoxy)propyl)sulfanyl]hexyl)sulfanyl]propoxy)methyl)oxirane; and 2-([3-([2-([3-(2-oxiranylmethoxy)propyl)sulfanyl]ethoxyethoxyethyl)sulfanyl]propoxy)methyl)oxirane, and combinations thereof.

16. The curable adhesive composition of claim 11 wherein the epoxy reactive thioether-containing compound is present in the adhesive composition at a level of from about 10 to about 80 parts by weight.

17. The curable adhesive composition of claim 16 wherein the epoxy resin is present in the adhesive composition at a level of from about 20 to about 80 parts by weight.

18. The curable adhesive composition of claim 17 wherein the curative comprises a poly(oxyhydrocarbolene) diamine.

19. The curable adhesive composition of claim 11 further comprising a coupling agent, a filler, or a combination thereof.

20. The curable adhesive composition of claim 17 wherein the catalyst comprises an imidazole.

21. An adhesive useful for bonding substrates comprising silicon, noble metal, plastics, polyimide, or a combination thereof comprising the reaction product of:
epoxy resin;
catalyst or curative; and

epoxy reactive thioether-containing compound.

22. The adhesive of claim 21 wherein the epoxy reactive thioether-containing compound has a molecular weight of from about 320 to about 650.

23. The adhesive of claim 21 wherein the epoxy reactive thioether-containing compound is selected from the group consisting of 2-([3-(2-(2-([3-(2-oxiranylmethoxy)propyl)sulfanyl)ethyl)sulfanyl]ethyl)sulfanyl]propoxy)methyl)oxirane; 2-([3-(6-([3-(2-oxiranylmethoxy)propyl)sulfanyl)hexyl)sulfanyl]propoxy)methyl)oxirane; and 2-([3-(2-([3-(2-oxiranylmethoxy)propyl)sulfanyl)ethoxyethoxyethyl)sulfanyl]propoxy)methyl)oxirane, and combinations thereof.

24. The adhesive of claim 21 wherein the catalyst is an imidazole.

25. The adhesive of claim 21 wherein the curative is a polyamine.

26. The adhesive of claim 21 further comprising an additive comprising silicon atoms.

27. The adhesive of claim 21 having low-stress and water and solvent resistance.

28. A method of flexibilizing and improving the solvent and/or water resistance of an epoxy resin adhesive comprising the steps of:

adding from about 10 to about 80 parts by weight of epoxy reactive thioether-containing compound to a curable epoxy resin adhesive composition; and

curing the epoxy resin adhesive composition to form the solvent and/or water resistant epoxy resin adhesive.

29. The method of claim 28 wherein the epoxy reactive thioether-containing compound is a thioether di-epoxide.

30. The method of claim 28 wherein the epoxy reactive thioether-containing compound is selected from the group consisting of 2-{{3-{{2-{{3-(2-oxiranylmethoxy)propyl)sulfanyl}ethyl)sulfanyl}ethyl}sulfanyl}propoxy)methyl}oxirane;
5 2({3-{{6-{{3-(2-oxiranylmethoxy)propyl)sulfanyl}hexyl)sulfanyl}propoxy)methyl}oxirane; and 2-{{3-{{2-{{3-(2-oxiranylmethoxy)propyl)sulfanyl}ethoxyethoxyethyl)sulfanyl}propoxy)methyl}oxirane, and combinations thereof.

10 31. The method of claim 28 wherein the epoxy resin comprises a polyfunctional phenolic glycidyl ether epoxy resin.

32. The method of claim 28 wherein the curative comprises an epoxy reactive amine.

15 33. The method of claim 28 wherein the catalyst comprises an imidazole.

34. The article of claim 1 wherein the substrate comprises polyimide.

20 35. The method of claim 8 wherein the epoxy reactive thioether-containing compound has a molecular weight of from about 320 to about 650.